

## **32.02 RESPONSIBILITIES OF THE TESTING AGENCY**

**32.02.1 General** All materials and operations shall be tested in accordance with these Specifications and as directed by the Project Manager. Agencies testing soil and rock shall meet the requirements of ASTM D3740. Agencies testing asphalt or concrete shall meet the requirements of ASTM D3666 or D1077, respectively. All Testing Agencies shall meet the requirements of ASTM E329.

A trained and properly qualified representative of the Testing Agency shall observe, sample, and test the materials and work, on the project, as required by these specifications and as directed by the Project Manager. If any materials furnished or the work performed by the Contractor fails to fulfill the Specification requirements, such deficiencies shall be reported to the Project Manager and the Contractor immediately. Preliminary written field reports of all tests and observation results shall be given to the Contractor or Developer immediately after they are performed. Field reports shall be made available to the Project Manager by the Testing Agency. Final reports shall be forwarded to the Project Manager no later than 1 week following the testing. Results of all tests taken, including failing tests, shall be reported.

Reports shall bear the seal and signature of a Professional Engineer registered in the State of Colorado and competent in the required testing practice. All test reports shall show the location where the test was performed or at which the work or batch represented by the test was placed. Test reports shall include all information specified in the AASHTO or ASTM test procedure used. Improperly completed reports will not be accepted. Certificate of Occupancy's will not be issued until all final reports indicating compliance with these specifications are reviewed and placed on file by the City. The Testing Agency personnel are not authorized to stop work, to revoke, alter, relax, enlarge, or release any requirements of the Specifications, nor to approve, accept, or reject any portion of the work.

## **32.03 TESTING**

**32.03.1 General** All testing methods and procedures performed by the Testing Agency personnel shall be in accordance with the applicable AASHTO and ASTM requirements and procedures (see Table 32.1). Test reports shall include the AASHTO and ASTM test designations of all tests taken. All testing and retesting services shall be at the expense of the Contractor or Developer, except on City Contracts. Initial testing on City Contracts shall be at the City's expense; all retesting due to failing tests shall be at the Contractor's expense.

When changes in materials or proportions are encountered during construction, or when the work fails to pass tests or fails to meet the Specifications, additional tests shall be taken as directed by the Project Manager. Failure of the Contractor or Developer to furnish satisfactory test data shall be sufficient cause for rejection of the work in question.

### **32.03.2 Soil Testing**

**32.03.2.01** All testing shall be according to AASHTO or ASTM as designated in Table 32.1-5.

**32.03.2.02** When density and moisture content are determined by a nuclear device, a sand cone density test shall be taken daily or at the discretion of the Project Manager or the City. If the results of the sand cone tests do not agree with the nuclear tests, use of that nuclear device shall be immediately discontinued until the cause of the disagreement is determined and corrected.

**32.03.2.03** A moisture-density determination shall be taken for each soil type encountered. For A-6 and A-7 soils, AASHTO T99 shall apply. All other soils use AASHTO T180.

**TABLE 32.1**

**SCHEDULE FOR MINIMUM MATERIALS SAMPLING AND TESTING FOR EMBANKMENT**

0	ASSHTO	ASTM	Minimum Frequency of Tests
<b>SOILS</b>	0		0
Sampling	T86	D420	One test per soil type
Soil Classification	M145	D3282	One test per soil type
Liquid Limit	T89	0	One test per soil type
Plastic Limit	T90	0	One test per soil type
Material Finer than 75 $\mu$ m Sieve	T11 T88	0	One test per soil type
Moisture Density (Proctor)	T99 T180	0	One test per soil type
<b>In Place Density</b>	0	0	0
(Nuclear)	T238 T239	D2922 D3017	One test for each 200 lane feet per layer or every 200 yds <sup>3</sup> (not less than one test per day)
Sand Cone	T191	D1556	One test for every tenth nuclear method in place density.

**TABLE 32.2**

**SCHEDULE FOR MINIMUM MATERIALS SAMPLING AND TESTING FOR AGGREGATE BASE COURSE**

0	AASHTO	ASTM	Minimum Frequency of Tests
<b>AGGREGATE BASE COURSE</b>	0	0	0
Sampling	T2	D75	One test per every 1000 tons or fraction thereof
Moisture Density	T180	D1557	One test per every 1000 tons or fraction thereof

Atterberg Limits	T89 & T90	0	One test per every 1000 tons or fraction thereof
Gradation	T27 & T11	0	One test per every 1000 tons or fraction thereof
In Place Density	T238 & T239	0	One test for each 200 lane feet per layer or every 200 yds <sup>2</sup>
Thickness	0	0	One test for each 200 lane feet per layer or every 200 yds <sup>2</sup>
Resilient Modulus	T294	0	Upon request

**TABLE 32.3**

**SCHEDULE FOR MINIMUM MATERIALS SAMPLING AND TESTING  
FOR BITUMINOUS PAVING MIXTURES**

0	AASHTO	ASTM	Minimum Frequency of Tests
<b>ASPHALT</b>	0	0	0
Sampling	T168	D979 D3665	One test per every 1000 tons or fraction thereof(not less than one test per day)
Marshall/Hveem Properties	T245 T247 T166	D1559 D1561	One test per every 1000 tons or fraction thereof(not less than one test per day)
In Place Density	0	D1188 D2950	One test for each 250 lineal Lane Feet per layer of in place HBP
Asphalt Content	T164 T269 TP53	D2172 D3202 PS90	One test per every 1000 tons or fraction thereof(not less than one test per day)
Maximum Specific Gravity of HBP	T209	D2041	One test per every 1000 tons or fraction thereof(not less than one test per day)
Air Voids & VMA	T269	D3203	One test per every 1000 tons or fraction thereof(not less than one test per day)
Thickness	0	D3549	One test for each 250 Lineal Lane Feet
Aggregate Gradation	T27	C136	One test per every 1000 tons or fraction thereof(not less than one test per day)

**TABLE 32.4**

**SCHEDULE FOR MINIMUM SAMPLING AND TESTING FOR PORTLAND  
CEMENT CONCRETE**

0	ASSHTO	ASTM	Minimum Frequency of Tests
<b>CONCRETE</b>	0	0	0
Sampling	T141	C172	One test per 50 yds <sup>3</sup>
Compressive Strength	0	C39	One set per 25 yds <sup>3</sup>

			One set per 50 yds <sup>3</sup> Paving
Temperature	0	C1064	One test per 50 yds <sup>3</sup>
Slump	T119	C143	One set per 25 yds <sup>3</sup> One set per 50 yds <sup>3</sup> Paving
Air Content	T196 T121	C173 C138	One set per 25 yds <sup>3</sup> One set per 50 yds <sup>3</sup> Paving
Thickness	0	C174	One test per 500 lineal Lane Feet (Paving)

**TABLE 32.5**

**SCHEDULE FOR MINIMUM MATERIALS SAMPLING AND TESTING  
FOR SLURRY SEAL**

0	AASHTO	ASTM	Minimum Frequency of Tests
Residue after distillation	T59	0	One test for each 5,000 yds <sup>2</sup> or fraction thereof (not less than one test per day)
Extraction and Gradation	T164 T30	0	One test for each 5,000 yds <sup>2</sup> or fraction thereof (not less than one test per day)
Application Rate	0	0	One test for each 5,000 yds <sup>2</sup> or fraction thereof (not less than one test per day)

**32.03.2.04** In addition to the requirements of Section 32.03, all reports shall include elevation or depth below finish grade at which test was taken. Results shall report densities (maximum dry and relative) to nearest 0.1pcf, moisture content (optimum and in place) to nearest 0.1%, and compaction (relative and required) to nearest 0.1. The most recent adjusted manufacturer's calibration curve must be available upon request. The manufacturer's calibration curve shall be adjusted as required by ASTM D2950.

**32.03.3 Asphalt Testing**

**32.03.3.01** All testing shall be according to AASHTO or ASTM as designated in Table 32.3.

**32.03.3.02 In-place density:** A minimum of One test for each 250 lineal Lane Feet per layer of in place HBP or fraction thereof.

**32.03.3.03 Aggregate gradation:** A minimum of 1 test per 1,000 tons or fraction thereof.

**32.03.3.04** In addition to the requirements of Section 32.03, all reports shall include densities to the nearest 0.1 lb. per ft<sup>3</sup> and compaction to the nearest 0.1%. If a nuclear device is used, the report shall contain the method used (i.e. back scatter, direct transmission, etc.)

**32.03.3.05** In-place pavement thickness shall be determined as follows: The pavement shall be cored at 500' intervals or fraction thereof, in each 12' lane (nominal), with a

minimum of 3 cores in any area. The Project Manager may require additional cores to define deficient areas.

**32.03.4 Concrete Tests**

**32.03.4.01** All testing shall be according to AASHTO or ASTM as designated in Table 32.4.

**32.03.4.02** Sampling and testing shall be required on all concrete work including curb, sidewalk, pans, pavement, slope paving, retaining walls, inlets, manholes, or any other structures.

**32.03.4.03** Maximum time between sampling and casting cylinders shall not exceed 45 minutes. If the concrete cannot be taken to the laboratory and cylinders cast within 45-minutes, the cylinders are to be cast in the field. Cylinders shall be transported to the laboratory within 24 hours of casting but after the concrete has hardened (see AASHTO T23). **Concrete cylinders shall be broken according to the following table.**

**TABLE 32.6**

**CONCRETE CYLINDER BREAKS**

<b>NUMBER OF CYLINDERS</b>	<b>BREAK INTERVAL (days)</b>
<b>FIELD CURED SERIES (4 Cylinders)</b>	0
2	7
2	14*
<b>LABORATORY CURED SERIES (6 Cylinders)</b>	0
2	7
2	28
2	45*

\* Or as directed by the Project Manager

One Laboratory Cured Series shall be taken for each 50 cubic yards of concrete placed or fraction thereof.

**32.03.4.05** Slump: AASHTO T119, Air: AASHTO T196 or T121. Test shall be taken for each 25 cubic yards of concrete placed or fraction thereof. A minimum of 3 slump and air tests shall be taken per day or as directed by the Project Manager. Slump and air tests shall be taken with each cylinder series.

**32.03.4.06** If samples of fresh concrete have not been obtained and tested, a minimum of 3 cores shall be taken per AASHTO T24 and broken. Air content, ASTM C451, and cement content, AASHTO T178, shall also be determined. Concrete in the portion of the structure from which the core was taken will be considered adequate if the average strength of the cores is equal to a minimum of 8 0% of the specified strength (f’c) and if the strength of no single core is less than 75% of f’c. All core holes shall be completely

filled with concrete meeting the same mix design criteria.

**32.03.4.07** In addition to the requirements of Section 32.03, all reports shall include: the type of structure; cylinders; data on obtaining, transporting, storing, curing, time between sampling and casting cylinders; supplier, batch ticket I.D., finisher and contractor.

#### **32.04 RESPONSIBILITIES OF THE CONTRACTOR OR DEVELOPER**

**32.04.1 General** The Contractor or Developer shall provide at his expense the required testing services except on City Contracts. Initial testing on City Contracts shall be at the City's expense. All retesting shall be at the Contractor's expense. The use of a Testing Agency's services does not relieve the Contractor or Developer of the responsibility to furnish the required materials and to perform the required construction in full compliance with the Specifications. Passing test results do not constitute acceptance of the work or materials represented by the test. The Contractor is responsible for quality control of his work.

**32.04.2 Testing Agency Access and Assistance** The Contractor or Developer shall: allow the testing agency access to the job site at all times; furnish any labor required to assist the Testing Agency in obtaining and handling samples at the source of material and at the project; provide and maintain, for the sole use of the Testing Agency, adequate facilities for safe storage and proper curing of concrete test specimens on the project site as required by AASHTO T23.

**32.04.3 Mix Designs:** When requested by the Project Manager, the Contractor or Developer shall furnish asphalt mix designs or concrete mix designs meeting the requirements of these specifications. Concrete mix designs shall be performed according to the provisions of ACI-211 or ACI-304. A separate mix design shall be provided if pumped concrete is used.

#### **32.05 Personnel Qualifications**

**32.05.1** The Person responsible for the Quality Control testing shall be a Registered Professional Engineer in the State of Colorado and practicing in this field.

**32.05.2** Technician shall be certified as Level II or higher NICET in the specific area where they perform tests, i.e. soils, concrete, asphalt.

**32.05.3** Technician taking samples and performing tests must possess one or more of the following qualifications:

**32.05.4** Technicians taking samples and conducting compaction tests must have a Level II A certification from LabCAT or equivalent.

**32.05.5** Technicians conducting tests of asphalt content and gradation must have a Level II B certification from LabCAT or equivalent.

**32.05.6** Technicians taking concrete samples and conducting field tests must have a Field certification from ACI or equivalent.

**32.05.7** Technicians conducting test of Portland Cement Concrete for compressive strength shall possess a certification from ACI Laboratory Grade I or equivalent.

**32.05.8** Technicians conducting test of Portland Cement Concrete for flexural strength and determine mixture design characteristics shall possess a certification from ACI Laboratory Grade II or equivalent.

**32.05.9** Technicians determining asphalt mixture volumetric and strength characteristics must have a Level II certification from LabCAT or equivalent.